

APPENDIX F: DRAFT FOREST ANALYSIS OF LONE PINE STATE PARK

DRAFT FOREST ANALYSIS OF LONE PINE STATE PARK

Lone Pine State Park sits between 3100 and 3600 feet, in the foothills SW of Kalispell. The park is predominately north facing with a moderate slope averaging 30%. There are a series of small flat benches and swells located along the tops and in-between the broad north facing ridges. The steepest slopes are located directly below a cliff in the SE corner of the park.

The park is located on the lower and drier limits of Douglas Fir series. Due to the parks northerly aspect and proximity to the valley floor, it is cooler than sites at similar elevations, but with different aspects. The park sits on the edge of a rain shadow, where the average precipitation in Kalispell is 16 inches a year. There is no running water in the park. There are a few small draws and depressions that help to retain moisture longer than the surrounding area.

A recent survey determined the park was 173 total acres. The forested portion of the park was traversed with a GPS system and determined to be 148 acres. This acreage includes the cliff in the SE corner, a small gravel pit in the NE corner, and any trails within the park.

METHODOLOGY

Atterbury Consultants developed the cruise program used to inventory the forested portion of the park. This program (SUPER A.C.E.) is widely used throughout the Pacific Northwest. The timber cruise generated the baseline forestry data needed to help write a timber management plan. The data collected included, amongst other things, what trees were present, how many, what size, how old, and the number that are diseased and dead.

The forested portion of the park was sampled using a randomly placed three-chain grid of plots. This represents a plot every .875 acre. This intensity insures that enough plots are taken to produce a statistically sound assessment. The overall statistics of the cruise indicates that 95% of the time another cruise performed will be within 5% of the volume estimated.

Cruise volumes are calculated by multiplying the volume per sample tree, times the trees per acre. The cruise volumes per tree are added, and then the sum of these volumes is divided by the number of plots to come up with the volume per acre of the entire stand. (Atterbury, 1988)

The focus is not on how much board feet there is, but rather, what is the percentage of mistletoe infected trees and how many trees per acre are there.

A variable plot method of forest sampling was used to perform the timber cruise. At each plot center a relaskop, with a basal area factor (BAF) of 20, was used to determine sample trees. The relaskop is an instrument designed to be used as an angle gauge for determining basal area per acre. The BAF estimates the basal area of trees within the plot radius.

The plot is where individual tree measurements are taken. The diameter, total height, bole length, defect, and crown ratio on all sample trees were measured. All sample trees are within a plot radius, which is determined by the individual tree diameter, the slope and the BAF. At each plot the following stand components were recorded: fuel complex; habitat type; understory plant species; and wildlife sign.

All sample trees were rated on the presence of mistletoe using the Hawksworth or DMR mistletoe rating system. On every fifth measure plot, the first tree of each species less than and greater than 15 inches in diameter was bored to determine total age and radial growth (last 10 years growth). On every third plot the number of trees that were in the plot radius were recorded but no measurements were taken.

All plots (96%) were documented with a Trimble Geo-Explorer. Each plot averaged 100 differentially corrected points. All plots were drawn onto the enclosed map and color-coded by the presence and severity of mistletoe. The GPS rover files for plot locations are copied on a floppy disc.

OVERSTORY

Lone Pine State Park is comprised of 85% Douglas Fir, 13% Western Larch and 1% Ponderosa Pine. The Douglas Fir component is further broken down into the following categories: 48% with little or no visible mistletoe infestation; 19% with moderate mistletoe infestation; 14.5% with severe mistletoe infestation; and 4% standing dead. Almost 3% of the larch are dead.

Close to 40% of the Douglas Fir is either dead or had visible signs of mistletoe. Of the 169 cruise plots recorded, 96 or 57% of the plots tallied had trees with mistletoe. One benefit of mistletoe is that it has created a mosaic of Douglas Fir at various stages of infestation and subsequently helped to break up uniformity of the stand.

Overall the Douglas Fir averaged 11.5 inches in diameter, 60-70 feet tall and 100 years old. The larch averaged 10 inches in diameter, 60 to 80 feet tall and 96 years old. On average the radial growth (last 10 years) for Douglas Fir was almost double that of the larch. The larch shows evidence of being suppressed and unhealthy, with narrow, sparse crowns with a lot of physical defect and very little recent growth. The remnant Ponderosa Pine is survivors of old fire.

The oldest trees recorded were a 33-inch DF that was over 300 years old and a 24-inch larch that was around 240 years old.

UNDERSTORY

Overall conifer regeneration is low. Almost all the seedlings and trees less than 4 feet tall are old and suppressed DF. A lot of the DF regeneration has mistletoe. There are some clumps of healthy DF seedlings and saplings in some of the small draws and swells. The lack of disturbance from fire and grazing, and the relatively closed forest canopy has created a thick mat of perennial grasses, moss, and duff that appear to be inhibiting conifer regeneration. When openings occur in the forest canopy from mistletoe induced mortality, there is often more conifer regeneration. In some openings there are healthy young larch.

The forest floor is predominately a uniform layer of snowberry, oregon grape, spirea, rose, native grasses and forbs. Shrubs present include chokecherry, serviceberry, blackberry, hawthorn, raspberry, maple, mountain ash, ninebark and oceanspray. Local noxious weeds observed include leafy spurge, knapweed, Canadian thistle, toadflax and sulphur cinquefoil.

HABITAT TYPE

Pfisters Forest Habitat Types of Montana was utilized to key out the habitat type at individual plot locations. The following discussion is summarized from this publication. The habitat type approach is a common way of classifying forested areas. It is based on determining the climax tree and the dominant or characteristic understory species present. It's based on the premise that all land areas potentially capable of producing the same plant communities at climax can be classified the same habitat type. The first step is to determine the appropriate climax series (final overstory species), followed by the habitat type and corresponding phase associated with this series by following a written dichotomous key. (Pfister, 1977)

Douglas Fir is the dominant and most successful reproducing conifer in the park. Snowberry is the dominant understory, and is also an indicator plant for the Douglas Fir / Snowberry habitat type. This is the most common habitat type in the park. This habitat type has 3 phases, with the pine grass phase being most prevalent.

The Douglas Fir/ Snowberry habitat type is found throughout a wide elevational range in Montana. The park sits on the drier, lower limits of this habitat type. Timber productivity in this habitat type varies with elevation and moisture. Overall, this is a productive growing site for trees and shrubs. The presence of rhizomatous grasses limits the regeneration of conifers.

When snowberry is absent, the habitat type changes to either Douglas Fir / Pine grass, Douglas Fir / Rough fescue or Douglas Fir / Ninebark. Slight changes in aspect produce different habitat types. On some ridges with westerly aspects there is no snowberry and the habitat type is often DF/ Pine Grass. In the SW and NW corners of the park the habitat type changes to DF/ Rough Fescue.

FOREST HEALTH

Douglas Fir Dwarf Mistletoe is prevalent throughout the park. The mistletoe is present throughout all age classes of the DF. Trees that are stressed from mistletoe are more susceptible to attack from beetles and other forest pests. There is evidence of old boring dust on some DF, indicating the presence of bark beetles. *Phellinus pini* conks were found on some of the larch indicating decadence.

The presence of mistletoe continues to threaten the overall health of the park forest. Mistletoe is a native parasitic flowering and seed bearing plant that feeds and survives on Douglas Fir. It gets all of its water and most of its minerals and carbohydrates from the host tree. The following discussion on the life history of dwarf mistletoe is summarized from the Forest Insect and Disease Leaflet #54 written by the U.S.F.S. Department of Agriculture.

Douglas Fir Dwarf Mistletoe is a plant with an aerial and internal component. The aerial component is the slender, olive green, perennial shoots, whose main function is reproduction. The internal component is the root like strands that are embedded in the host trees' wood. These strands take water and nutrients from the host tree and will live as long as the adjacent host tissue lives. (Hadfield, 2000)

Flowering occurs in late spring. Male and female flowers are on separate trees. Wind and insects facilitate pollination. Only female plants produce seeds. The seeds mature in late summer and are literally propelled from their skins and typically land within 10 to 15 feet from the disseminating shoot. The seed remains dormant all winter. Germination occurs in the spring, typically at a needle base.

The first signs of infestation are swelling in branches and stems. It takes 2 to 5 years for aerial shoots to form on infected trees. Female plants produce their first seeds in 4 to 6 years. Witches brooms are formed after 10 years.

Douglas fir dwarf mistletoe spreads locally from seed dispersal. In single storied stands (i.e. Lone Pine) horizontal spread averages 1.5 to 2 feet per year. In multi storied stands the spread is faster. Tall trees with plants in their upper branches will spread seed a greater distance than smaller trees.

There seems to be a correlation between light and increased broom size. Severely infested areas increase in size because dying trees create more light and adjacent brooms grow bigger. Therefore if openings are created by tree removal, it's important that trees on the perimeter be, for the most part, free of mistletoe.

Douglas fir dwarf mistletoe kills trees directly. It reduces both the height and diameter of its host species. Heavily infected trees produce fewer seeds and seeds of lower viability than healthy trees. Trees with bole infections are structurally weaker than healthy trees.

The dwarf mistletoe rating system (DMR or Hawksworth) categorizes the intensity of mistletoe in individual trees and the park forest. When looking at an individual tree, the live crown is divided into thirds and each third is rated with the following criteria: 0 no visible infection, 1= light infection, 2= severe infection. The overall rating for each individual tree is determined by the sum of the three parts.

In the timber cruise two additional species were created. Douglas fir with a severe rating (SDF), and Douglas fir with a moderate rating (MDF). Trees with ratings of a 2 or 3 were cruised as MDF, while trees with ratings of 4 or greater were cruised as SDF. If a tree had a severe bole attack, and little other mistletoe, it was cruised as SDF.

FUELS

Fishers, Photo Guide for Appraising Downed Woody Fuels in Montana Forests is the guide used to evaluate and classify potential fire behavior. On every other measure plot the fuel complex on the ground was compared with the photo or photos that best matched it. While this was a subjective process, and there were no photos that showed fuels caused by mistletoe, it did provide information for rating fire potential. Overall fire potential is a function of rate of spread, intensity, torching, crowning and resistance to control. (Fisher, 1981)

There were four major fuel complexes repeatedly seen. The two most common fuel complexes had a moderate rating for intensity, a moderate and high rating for rate of spread, and a moderate overall fire potential. All other fuel complexes observed had a low rating for fire potential.

There are many factors that contribute to an overall forest fire hazard rating. Some factors such as prevailing wind patterns, weather conditions, topography, and possible sources of ignition are not changed by a fuels reduction program (Fisher, 1981). There is still debate on the effectiveness of reducing fuels by mechanical means.

Trees severely infested with mistletoe are more flammable and less likely to survive a fire than healthy trees. Wildfire risk increases because of the highly flammable witches' brooms in the lower branches and the dead brooms at the base of trees. The witches' brooms serve as fuel ladders for fire to spread to the tree crown. Because the brooms have a lot of dead branches they will often ignite prior to the main fire arriving.

There are areas in the park that are severely infested with mistletoe. These "patches" have a mix of standing dead trees, trees with dead or dying tops, and trees with witch's brooms. Forest fuels are increasing as the mistletoe continues to kill trees and cause more dead branches and brooms to accumulate on the forest floor.

WILDLIFE

The park serves as a corridor and haven for wildlife. Whitetail deer, black bear, badger, rabbit, ground squirrels and a coyote were observed. Also observed were pileated, hairy, and downy woodpeckers, flickers, pygmy owl, turkey vultures, kestrel, redtail hawk, golden eagle, grouse, ravens, magpies, nuthatches, grosbeaks, chickadees and swallows.

One benefit of mistletoe is the increased structural diversity it creates in the forest. Some areas in the park with a lot of mistletoe have more plant diversity than surrounding areas. The witch's brooms increase-hiding cover for big game. Downed branches, brooms and trees create nest and feeding sights for small mammals, reptiles and insects.

Birds use the brooms, swollen branches and broken tops of mistletoe infected trees for nesting, roosting and feeding. A variety of bird species feed on the seeds of mistletoe and the insects associated with dead and dying trees. Woodpeckers create cavities in snags for a variety of species.

The timber cruise estimated 6 DF and 4 WL snags per acre. The DF snags averaged 11 inches in diameter and 25 feet tall, while the WL snags averaged 10 inches in diameter and 62 feet tall. Since close to 15% of the DF component is severely infested with mistletoe there will be a continual supply of future snags. It is important to document the location and monitor the condition of large trees that are potential snags. Girdling severely infected trees creates more snags.

A majority of the shrubs were tall, decadent and appeared to be under utilized by deer as forage. However, there is some evidence of winter forage use.

INTERPERTATION

There are wonderful opportunities to develop interpretive exhibits and environmental education programs involving the Park Forest ecosystem.

One interpretive option is to develop an exhibit on the life history of mistletoe. The exhibit could be located within an area of the park infested with mistletoe. Different stations could address different aspects of mistletoes life history.

Developing educational opportunities that require the public to be actively involved in an aspect of the forest should be encouraged. Hands on interpretive options include, having people actually measure tree heights and diameters. A series of stations could be located next to the park trails where people could actually take forest measurements. A key could be written for a station that lists the heights and diameters of the trees present. People could sign out forestry equipment and compare their measurements with the key to the individual stations.

HISTORICAL PERSPECTIVE

Past logging activities are evident in the park. Logs appeared to have been skidded down some of the north facing draws. Old stumps indicate that the larger diameter larch, pine and fir were removed. It's difficult to judge what the species composition of the park was prior to logging and fire suppression.

The larger diameter trees show evidence of past fires. Frequent low intensity fires probably kept the smaller DF in check and help maintained a more "park like" mosaic of larger fire resistant trees. Due to the parks northerly aspect, it is suspected the park was a mix of large larch, fir and pine.

MANAGEMENT CONSIDERATIONS

The park is a contiguous stand of even age DF. Most of the larch is suppressed and unhealthy. Over 50% of the forested area are host to mistletoe. Responding to the mistletoe problem within the park and the potential threat from wildfire will be a priority of any park management plan.

Prescribed Fire:

The reintroduction of fire as a change agent in the park would be beneficial. Low intensity underburns reduce fuels by burning downed brooms, branches and trees. Fire reduces the thick grassy mat and duff layer that is an obstacle to conifer regeneration.

In natural environments, wildfire plays a key role in keeping mistletoe populations under control. Unfortunately, because there is so much mistletoe in the park, a wildfire would consume a good portion of the park.

Ideally, fire should be part of an overall strategy to improve forest health. Performing an underburn, or broadcast burning a patch of mistletoe, would also help increase park diversity. There would be many positive results from reintroducing fire to the park, however, fire alone will not help solve the mistletoe problem.

Due to the proximity of the park to town and private land, and the uncertainty of containing a prescribed fire, it's unlikely the public will support a controlled burn program. It's probably even more unlikely that Montana F.W.P. would want to assume the liability of starting a burn program.

Chemical:

The Environmental Protection Agency for use on dwarf mistletoe registers Ethephon, a chemical agent. This chemical has been used for years in commercial growing operations to hasten fruit ripening. When applied to mistletoe prior to seed dispersal it causes the shoots to dry up and die. The chemical does not effect the internal mistletoe component and therefore must be repeated every three to five years. Because there is so much mistletoe in the park it's not economically feasible, practical or even desirable to use

Ethephon as a control agent. In addition, while Ethephon is labeled environmentally safe, the public may not be in support of widespread pesticide use in an area frequented by people

Tree Removal:

In order to help reduce the spread of mistletoe in the park, some type of tree removal will need to occur. If fire is not a viable option, than a carefully planned form of logging needs to be adopted.

Option 1:

The traditional approach to treating mistletoe in commercial forests is to remove all mistletoe-infected trees, pile and burn all the slash, and plant mistletoe resistant trees. This would involve cutting over one third of the Douglas Fir. Because of the parks moderate slope, a mechanical harvester could be used. A harvester is driven through the park, cutting and sorting trees as it goes. To minimize impact to the forest floor, the operation could be undertaken in the winter.

This is basically a commercial thinning of the park. One drawback of this approach is the end result often ends up looking like a tree farm. Because this is a public park with a resident wildlife population, it's important to maintain the look and function of a natural forest.

Option 2:

Another alternative would be to manage the mistletoe as a native plant and a natural part of the Park Forest. This would involve minimal removal of trees, and allowing the mistletoe to proliferate.

What this option would accomplish is some reduction of the forest fuels, and some control of the mistletoe infestation. Dead and downed branches and trees can be piled by hand and either removed or burned. Then a tree maintenance program could be adopted. Witches brooms could be pruned from live trees. Select mistletoe infested trees could either be girdled or cut.

If no action is taken to mitigate the mistletoe problem, the end result will be a mistletoe-infested forest, which is still highly susceptible to fire and disease.

Option 3:

A more alternative approach is to create small openings in the forest through selective tree removal. The openings will make it harder for the mistletoe to spread, by removing live host species, and increase the distance for seeds to travel. It also creates areas to plant healthy conifers and shrubs. The openings will increase overall diversity by creating more of an edge effect. The openings also serve as small fire breaks in the advent of a wild fire and can be irregular in shape. The size of the openings will depend on their location and how much mistletoe is present.

Deciding where the actual openings will be made will require mapping and planning in the field. Since most plots have GPS coordinates, a map depicting the areas of high mistletoe concentration could be developed. Openings can be made that meet a variety of park management objectives. Creating openings in the forest canopy will create additional views of the valley and surrounding mountains.

Tree removal would occur through a selective logging operation. It is not necessary or desirable to remove all the large diseased Douglas Fir. There can still be small islands of diseased trees within the middle of harvested areas. There also will be areas where no action is taken, and if mistletoe is present, it will be able to complete its life cycle.

The logging method chosen will depend upon the project size, time frame, and money. Horse logging has been mentioned as an alternative to traditional logging methods. Horse logging is more ecologically sensitive than a skidder or mechanical harvester. One major draw back of horse logging is that it takes longer than conventional logging methods to complete a project. Helicopter logging is a fast ecologically sensitive way to remove trees, but is expensive.

No matter what method is chosen, any time logs are moved, they will disturb the soil and native plants. Openings can be designed to minimize the skidding of logs and to help facilitate the decking and yarding of logs. Existing roads and trails could be used to skid and transport logs. The skidding or moving of logs breaks up the duff and grass layer and does help prepare the site for planting. Any skid trails or disturbed sites would need to be reclaimed, seeded and planted. Particular attention must be paid to preventing the encroachment of noxious weeds.

A significant part of any tree removal project is the slash cleanup. Mistletoe infested trees produce a lot of slash. A decision will need to be made on what to do with the slash, whether to pile and burn it, or remove the slash and dispose of it somewhere else.

A planting schedule and plan will need to be written in conjunction with the final forest management plan.

Considerations:

Visitor use is high at Lone Pine State Park. Any tree removal project will require closing the park, or a portion of it. An ongoing logging operation poses safety and liability issues. It is important to minimize the amount of time that logging equipment is used. Once a course of action is chosen its best to accomplish the majority of your forestry goals with one well timed entry.

Because this is a state park, and the trees a public resource, it's important to maximize the value of any trees removed. For example, if 50% of the mistletoe- infected trees were removed, that would be approximately 300,000 board feet of timber. If the market paid \$400.00 per thousand board feet, that would generate \$120,000 minus logging costs. Revenue generated could pay for plantings, cleanup, and interpretive options.

A long-term management goal should be to reduce or slow the encroachment of mistletoe into areas that is non or lightly infected. While it is impossible and unwarranted to remove the mistletoe from the park, it's important that a plan be developed to mitigate its effects. This report serves as the first step in developing a forest management plan.